

*Painesville PRP Group*

**Non-responsive**

US EPA RECORDS CENTER REGION 5



494315

October 20, 2009

Ms. Teri Heer  
Site Coordinator  
Ohio EPA Division of Emergency and Remedial Response  
2110 E. Aurora Road  
Twinsburg, Ohio 44087

RE: Transmittal of Revised Notification of Design Modification to Operable Unit 16 (OU16) Site Improvements Project - Former Diamond Shamrock Painesville Works Site; TER016.600.0005.

Dear Ms. Heer:

Ohio EPA provided comments on the original "Notification of Design Modification to Operable Unit 16 (OU16) Site Improvements Project" (Work Plan) submitted September 24, 2009. Comments were received from you and Dr. Timothy Christman during a telephone conference with the Painesville PRP Group (PRP Group) on Monday, September 28, 2009. The attached Revised Work Plan contains additional information on the design of the storm water management system as well as additional details for construction of the storm water runoff swales as requested by Ohio EPA during the aforementioned conference call.

Thank you for the opportunity to provide the additional information and revisions. Please call me directly at (517) 651 - 2400 or Matt Montecalvo with Hull & Associates, Inc. at (440) 232-9945 with your approval or with any questions.

Sincerely,

 Teresa C. Jordan  
Site Coordinator

Enclosures

cc: Dr. Timothy Christman, Ohio EPA  
Ms. Linda Martin, US EPA  
Mr. Enrique Castro, Tierra Solutions, Inc.  
Ms. Chris DeJarlais, Boulder Environmental Consulting  
Ms. Johanna Coulter, Andrews Kurth  
Mr. Byron Best, for Tierra Solutions, Inc.  
Mr. Todd Davis, Hemisphere Corporation  
Ms. Jenifer Kwasniewski, JK Environmental Solutions  
Mr. Matthew Montecalvo, Hull & Associates Inc.

## REVISED WORK PLAN – NOTIFICATION OF DESIGN MODIFICATION TO OPERABLE UNIT 16 SITE IMPROVEMENTS PROJECT

Since the fall of 2007, the Painesville PRP Group (PRP Group) has been engaged in completing work associated with the approved Interim Action Work Plan (IAWP) for Operable Unit 16 (OU16) Site Improvements, which was approved by US EPA on October 19, 2006 and by Ohio EPA on October 30, 2006. To date, this work has resulted in the embankment of approximately 500,000 cubic yards of clean soil on OU16. This soil has been used in the construction of the proposed, low-permeability clay layer over the entire OU16 site, and was used to cover approximately 84 acres of OU16 with engineered fill suitable to support storm water and irrigation infrastructure for future golf course construction. Storm water improvements have also been implemented as described in the approved IAWP. The installation of 163 catch basins and manholes connected by over 18,980 feet (over 3.5 miles) of storm sewer pipe has also been completed since the start of work on OU16.

The PRP Group recently reviewed the grading and storm sewer installation design within an approximately 16-acre area located in the southwestern portion of OU16 prior to the completion of these designed improvements. The PRP Group proposes to modify the project design within this area in order to reduce the magnitude of additional fill quantities that otherwise would be required to finish this portion of the work pursuant to the original design. These proposed modifications are consistent with the objectives of the approved IAWP, and the area where changes are proposed is shown on Figure 1.

The PRP Group engaged their environmental, engineering, and surveying consultants (Hull & Associates, Inc., CT Consultants, Inc., and URS Corporation) to re-evaluate this 16-acre portion of OU16. Several design requirements were implemented prior to this re-evaluation to maintain consistency with the approved IAWP:

1. No work would be conducted that would result in less than 24 inches of the existing clay cap material to maintain the vertical separation required by the approved IAWP.
2. A minimum of six inches of low-permeability material (a minimum value of  $1 \times 10^{-7}$  centimeters per second vertical conductivity) would be placed above the 24-inches of existing clay cap material to ensure a reduced infiltration rate over the entire OU16 area.
3. Surface water run-off would be managed such that no water would be permitted to pond or lay stagnant within the limits of OU16 to maintain consistency with Ohio and US EPA requirements regarding storm water management on OU16.
4. All disturbed surfaces would be stabilized pursuant to the Storm Water Pollution Prevention Plan (SWP3) requirements of the original design and with the IAWP to prevent erosion.

A revised grading and drainage plan was developed based on those criteria. Figure 2 shows the proposed modifications. A comparison of Figure 1 and Figure 2 shows that less soil will be embanked based on the proposed modifications. The revised grading and drainage design also requires some storm sewer pipes originally intended to be covered by the additional golf course fill material to be replaced with storm water conveyance swales in the proposed design. Additional details of the storm water conveyance swales are shown in Figure 3 and Figure 4.

Implementation of this plan will be conducted in the same manner as described in the approved IAWP:

1. All appropriate SWP3 requirements will be implemented;



2. Any necessary grading cuts into the existing clay cap material will be completed (leaving a minimum 24 inches of existing clay cap material);
3. Placement of the minimum 6-inch layer of low-permeability clay material will be completed above the existing cap material;
4. Additional soils required for storm water drainage will be embanked;
5. Storm water conveyance swales will be installed (in lieu of storm sewers); and
6. Seeding and stabilization of all disturbed areas will be conducted according to the SWP3 requirements.

The modifications proposed in the attached revised grading and drainage plan will result in less storm sewer being installed. Approximately 2,940 feet of storm sewer pipe and as many as 23 catch basin structures will not be installed within the area shown on Figure 1. Storm water conveyance swales will be installed to appropriately manage the storm water in lieu of the planned storm sewers. An engineering analysis was performed and predicted storm water flows and velocities resulting from the upstream storm sewer flows were used to establish the appropriate size and erosion protection in the swales. The foregoing analyses lead to the design of stone erosion protection for the location of each storm sewer outlet into the swales and to the proposed use of Jute Mat to line the swales. Documentation of the analyses is provided in Attachment A of this work plan. As a result of the proposed re-design, the storm water conveyance swales will provide the same capacity for storm water flow as the uninstalled storm sewer. Implementing these revised project requirements also will result in approximately 47,000 fewer cubic yards of clean soil fill.

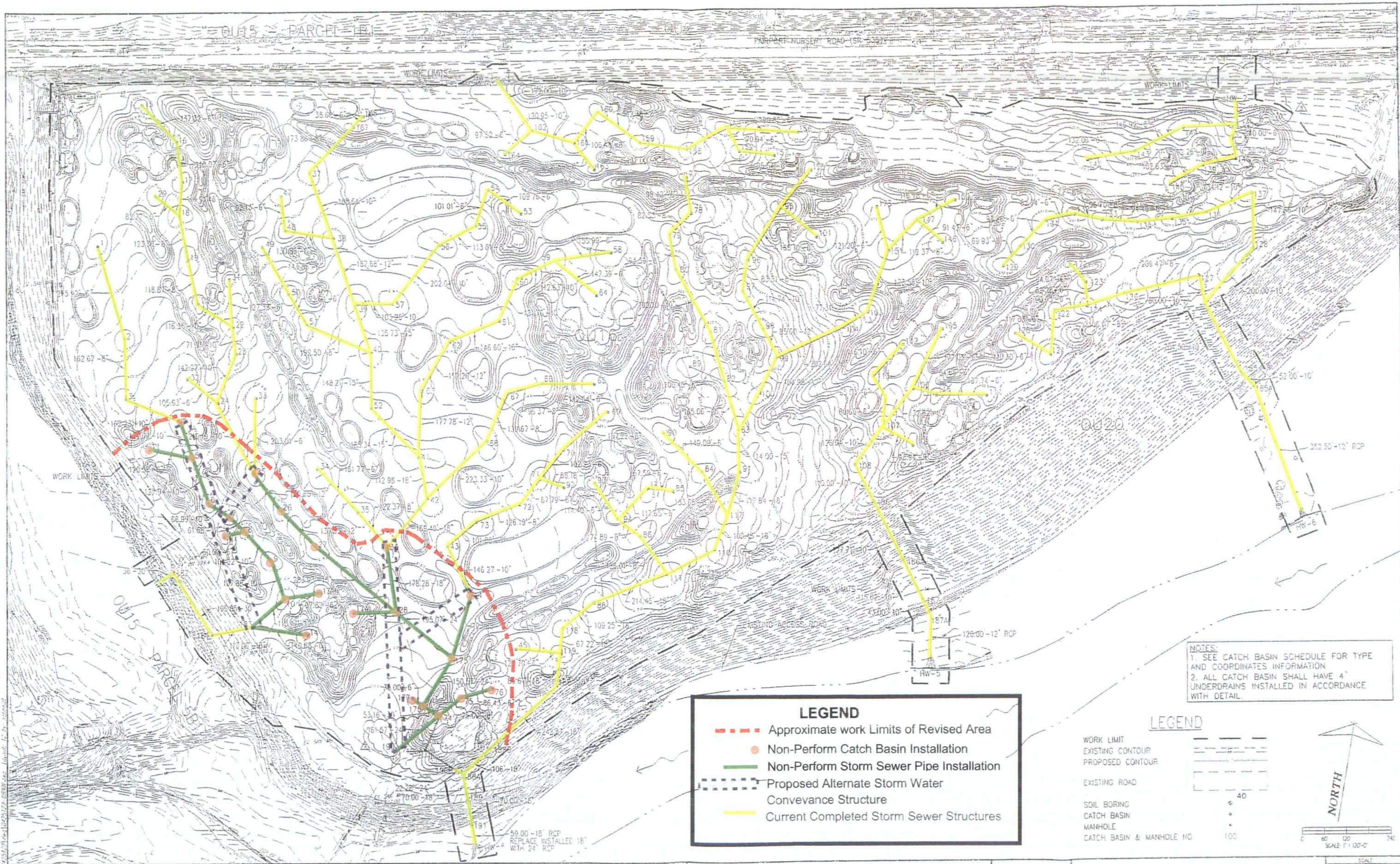
A 6 to 12 inch layer of sand material was also proposed as part of the IAWP. As was previously discussed with Ohio EPA, this layer of sand material was designed as part of the golf course construction. Delays in golf course construction also necessitate a delay in installation of the proposed sand material. The PRP Group acknowledges that lateral drainage is an important factor in reducing overall infiltration on OU16. However, the infiltration model conducted for the approved IAWP (the Hydrologic Evaluation of Landfill Performance [HELP] model) shows that the sand layer associated with the design specific to the original construction had no significant effect on the actual performance of the cap system. Rather, the capacity of the storm water run-off infrastructure was the limiting factor to the storm water infiltration portion of the overall infiltration quantity obtained from the HELP model. As the capacity of the storm water run-off infrastructure has remained the same, the absence of the sand layer will not materially affect the cap performance. Further, the entire surface of OU16 will be covered with topsoil and a vegetative cover to complete the work.

The modifications still will result in the completion of the 6-inch minimum, low-permeability clay layer over the entire area of OU16. A minimum of 24 inches of underlying, existing clay material also will be maintained, and the resulting grades on OU16 will continue to meet the objective of reduced infiltration and improved site drainage.

In summary, these changes to the OU16 Site Improvements design will have no significant impact to the objectives of the approved IAWP for OU16. The PRP Group has begun implementing the proposed design changes and anticipates completion by October 23, 2009.

## FIGURES





**LEGEND**

- Approximate work Limits of Revised Area
- Non-Perform Catch Basin Installation
- Non-Perform Storm Sewer Pipe Installation
- - - Proposed Alternate Storm Water Conveyance Structure
- Current Completed Storm Sewer Structures

**LEGEND**

- WORK LIMIT
- EXISTING CONTOUR
- PROPOSED CONTOUR
- EXISTING ROAD
- SOIL BORING
- CATCH BASIN
- MANHOLE
- CATCH BASIN & MANHOLE NO

SCALE: 1" = 100'-0"

**NOTES:**

1. SEE CATCH BASIN SCHEDULE FOR TYPE AND COORDINATES INFORMATION
2. ALL CATCH BASIN SHALL HAVE 4" UNDERDRAINS INSTALLED IN ACCORDANCE WITH DETAIL

Copyright © 2008 by CT Consultants, Inc. All rights reserved. No part of this document may be reproduced without written permission from CT Consultants, Inc.

**CT Consultants**  
engineers|architects|planners

35000 Kaiser Court, Willoughby, Ohio 44094  
440.957.9000 www.ctconsultants.com



REV NO	DESCRIPTION	DATE	BY	CHECKED
2	COMBINED OUTFALLS 4 & 7 AND EXTENDED OUTFALLS 5, 6	2/07	SAW	LCS
3	REVISE HEADWALL 2	3/08	LCS	LCS
4	REVISE ALIGN. CB#26 - HW#3	2/08	LCS	LCS
5	REVISE ALIGN. CB14-HW3, CB26-CB188A	3/08	LCS	LCS
6	REVISE ALIGN. CB188-CB188A, CB190A-CB188A	9/08	SAB	LCS
7	REVISE ALIGN. CB188-CB188A, CB74-CB188A	12/08	LCS	LCS

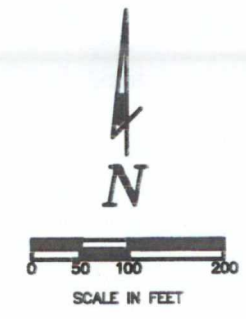
LAKEVIEW BLUFFS  
OPERABLE UNIT 16  
GRADING AND DRAINAGE PLAN  
PAINESVILLE TOWNSHIP, LAKE COUNTY, OHIO

DATE: DECEMBER 2008
DRAWN BY: KPA
CHECKED BY: DMB
APPROVED BY: JWH
FILE NO: FC

**FIGURE 1**  
**STORM SEWER PLAN**  
SEPTEMBER 11, 2009

SCALE: AS NOTED
CONTRACT NO: 04251-29
SHEET NO: 12 OF 39





- 1) ALL FEATURES ON THIS MAP WERE OBTAINED FROM URS CORPORATION.
- 2) THE REVISED SET OF PROJECT REQUIREMENTS FOR THIS AREA WAS DEVELOPED BY HULL & ASSOCIATES, INC., CT CONSULTANTS AND URS CORPORATION.

PLOT DATE: 9/14/09

# OU16 DRAINAGE SWALES LAKEVIEW BLUFFS

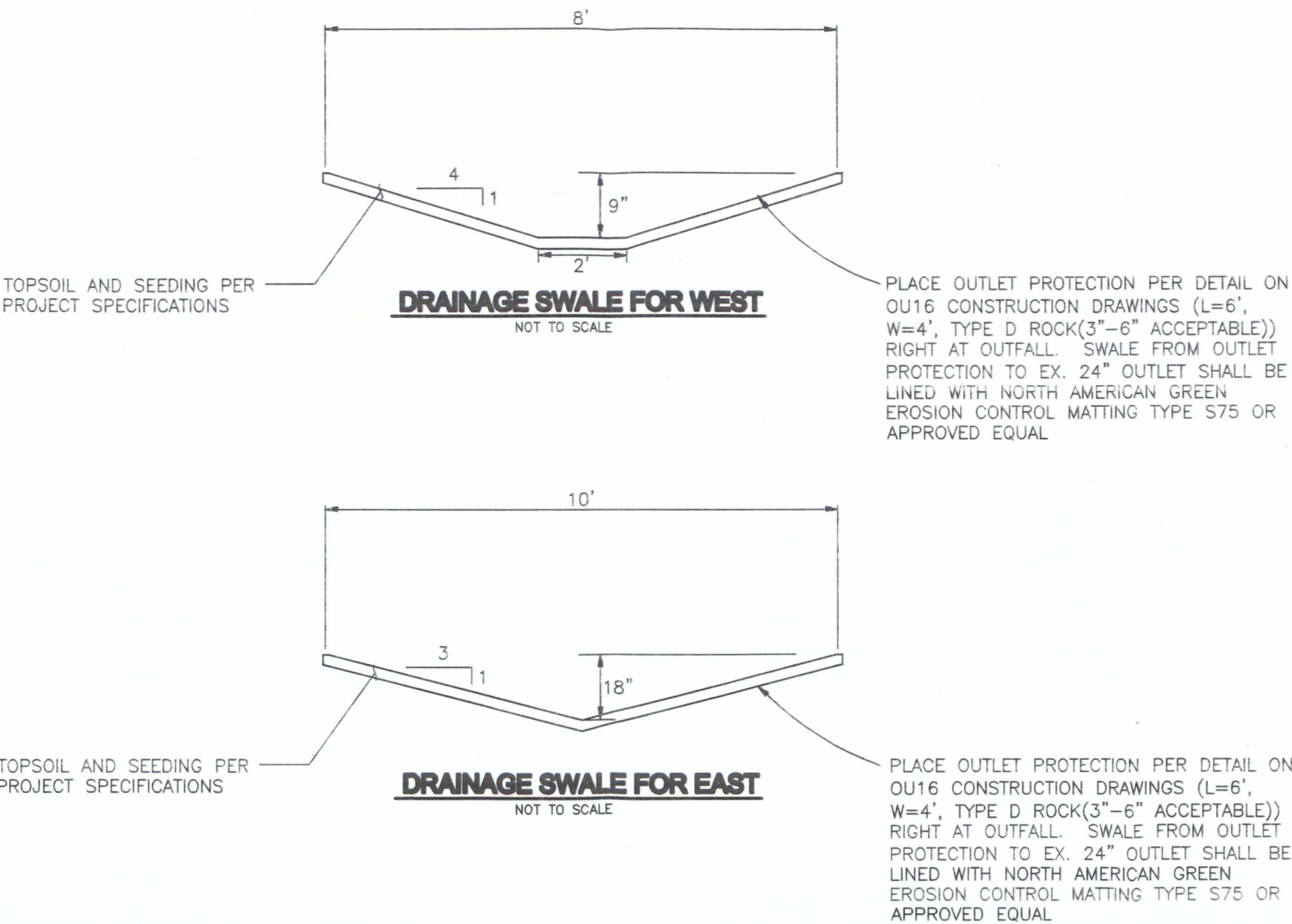
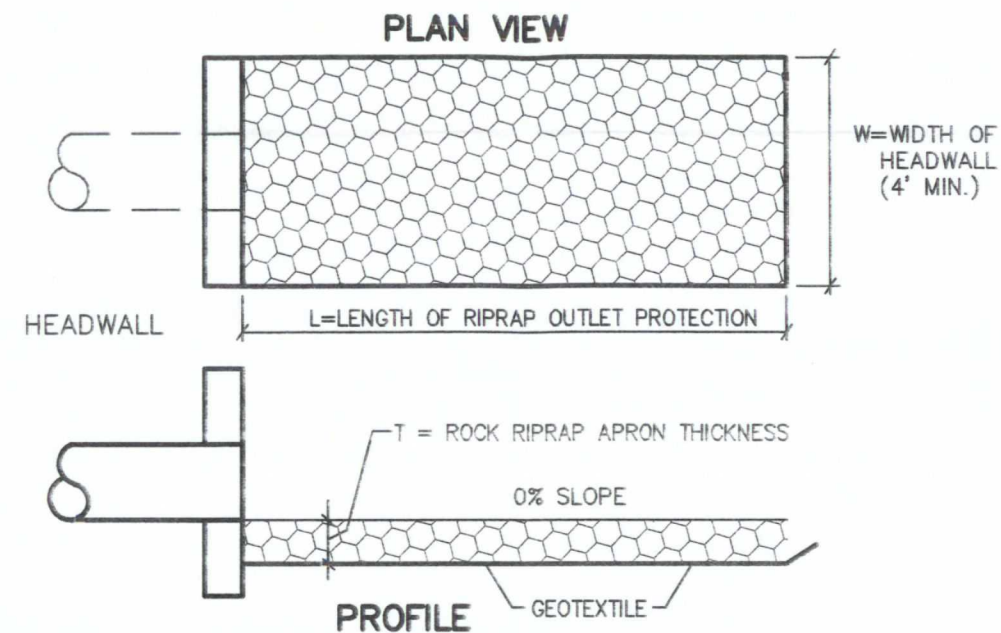


FIGURE 3

10/13/09



# OU16 DRAINAGE SWALES LAKEVIEW BLUFFS



## NOTES:

1. THE SUBGRADE FOR THE FILTER AND RIPRAP SHALL BE PREPARED TO THE REQUIRED LINES AND GRADES SHOWN ON THE PLAN.
2. THE RIPRAP SHALL CONFORM TO THE GRADING LIMITS AS SHOWN ON THE PLAN.
3. GEOTEXTILE SHALL BE WOVEN OR NONWOVEN MONOFILAMENT YARN AND SHALL MEET THE FOLLOWING:
  - THICKNESS 20-60 MILS
  - GRAB STRENGTH 90-120 LBS
  - ASTM D-1777 AND ASTM D-1682
4. RIPRAP MAY BE PLACED BY EQUIPMENT BUT SHALL BE PLACED IN A MANNER TO PREVENT DAMAGE TO THE GEOTEXTILE.

## STORM SEWER OUTLET PROTECTION

NO SCALE

## ATTACHMENT A

Hydrologic Analysis of Storm Water System Modifications

## **OU16 – Grading and Drainage Design Modifications**

### **Drainage Swale Scour Analysis Summary**

Scour erosion analysis of the proposed drainage swales was performed for OU16 Grading and Drainage Design Modifications. The ODOT Ditch Analysis program was used given proposed conditions for the two channels. Five, 25 and 50-year frequency storm events were used as part of the analysis.

The west channel with 8.2 acres of drainage area exhibited flow velocities of 2.0 feet per second (fps) and shear values of 0.4 pounds per square foot (psf) for the 50-year event. The easterly channel with 23.2 acres of drainage area exhibited flow velocities of 2.8 fps and shear values of 0.9 psf for the 50-year event.

The recommended S75 Erosion Control Blanket will provide stability for up to 5 fps velocities and up to 1.55 psf shear. In both cases, use of this material will provide protection to limit scouring. The functional longevity of the Erosion Control Blanket is 12 months. Established vegetation in the channel will then provided stability for 1.00 psf of shear, protecting both channels from scouring.

See the drainage swale recommended sections that include material callouts. Ditch Analysis sheets for the three storm events and a summary chart of that data is also provided. Figure 2 indicates locations of the east and west channels.

In summary, the planned temporary and permanent erosion protection measures are shown by the attached calculations to provide suitable protection for the 5, 25 and 50 year frequency storm events.

#### Attachments:

Summary of Ditch Analysis  
ODOT Ditch Analysis Results  
Figure 2  
Drainage Swales Details  
Outlet Protection Details  
S75 Specification Sheet





# Summary of Ditch Analysis

## OU16- Lakeview Bluffs

13-Oct-09

### Westerly ditch from CB#4 and CB#25

Storm yr	Flow cfs	Velocity ft/s	Shear lb/ft <sup>2</sup>	Depth ft	Width ft
5	3.80	1.80	0.32	0.52	6.16
25	5.42	1.98	0.38	0.61	6.92
50	5.76	2.01	0.40	0.63	7.06

### Easterly ditch from CB#36 to CB#44

Storm yr	Flow cfs	Velocity ft/s	Shear lb/ft <sup>2</sup>	Depth ft	Width ft
5	11.32	2.57	0.76	1.21	7.27
25	16.06	2.80	0.86	1.38	8.29
50	17.11	2.85	0.88	1.42	8.49



**Designer : LCS**

Temporary Mat:	1.00
Type 3:	5.00

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION		SIDE	LENGTH	RADIUS	IN		BACK	GRADE	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH
BEGIN	END		(ft.)	WIDTH	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./sq.ft.)	FLOW	FLOW	FLOW	
			(ft.)	(ft./ft.)	(ft./ft.)			(acres)				(in./hr.)	(yrs.)			(min.)	(fps.)			(ft.)	(ft.)	
		C	600.00	2.00	4.00	4.00	0.0100	8.21	8.21	0.15	1.23	Seed	3.18	5	0.030	19.32	2.23	0.29	3.92	0.46	5.66	
												Seed	3.09	5	0.040	20.33	1.80	0.32	3.81	0.52	6.16	



# DITCH ANALYSIS

**PID :**                      **Date :** 10/02/2009    **Project :** OU16 Temprrary ditches

**Location :** OU16 - Lakeview Bluffs

**Description :** Westerly ditch from CB #4 and CB #25

**Designer :** LCS

**Rainfall Area :** A

**Allowable Shears**

	<b>Seed:</b>	0.30	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE (ft.)	LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
		C	600.00	2.00	4.00	4.00	0.0100	8.21	8.21	0.15	1.23	Seed	4.52	25	0.030	18.93	2.46	0.34	5.57	0.54	6.34
												Jute Mat	4.40	25	0.040	19.86	1.98	0.38	5.42	0.61	6.92
												Jute Mat	4.40	25	0.040	19.86	1.98	0.38	5.42	0.61	6.92





# DITCH ANALYSIS

**PID :**                      **Date :** 10/02/2009    **Project :** OU16 Temprary ditches

**Location :** OU16 - Lakeview Bluffs

**Description :** Westerly ditch from CB #4 and CB #25

**Designer :** LCS

**Rainfall Area :** A

**Allowable Shears**

	<b>Seed:</b>	0.30	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE (ft.)	LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
		C	600.00	2.00	4.00	4.00	0.0100	8.21	8.21	0.15	1.23	Seed	4.81	50	0.030	18.86	2.50	0.35	5.93	0.56	6.47
												Jute Mat	4.68	50	0.040	19.77	2.01	0.40	5.76	0.63	7.06
												Jute Mat	4.68	50	0.040	19.77	2.01	0.40	5.76	0.63	7.06



# DITCH ANALYSIS

**PID :**                      **Date :** 10/02/2009    **Project :** OU16 Temporary Ditches                      **Location :** OU16 Lakeview Bluffs

**Description :** Easterly ditch from CB#36 and CB#44

**Designer :** LCS

**Rainfall Area :** A

**Allowable Shears**

	<b>Seed:</b>	0.30	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE (ft.)	LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
		C	550.00	0.00	3.00	3.00	0.0100	23.16	23.16	0.15	3.47	Seed	3.32	5	0.030	17.80	3.20	0.68	11.54	1.10	6.58
												Jute Mat	3.26	5	0.040	18.48	2.57	0.76	11.32	1.21	7.27
												Temp. Mat	3.26	5	0.040	18.48	2.57	0.76	11.32	1.21	7.27
												Temp. Mat	3.26	5	0.040	18.48	2.57	0.76	11.32	1.21	7.27



# DITCH ANALYSIS

**PID :**                      **Date :** 10/02/2009    **Project :** OU16 Temporary Ditches                      **Location :** OU16 Lakeview Bluffs

**Description :** Easterly ditch from CB#36 and CB#44

**Designer :** LCS

**Rainfall Area :** A

**Allowable Shears**

	<b>Seed:</b>	0.30	<b>Jute Mat:</b>	0.45	<b>Temporary Mat:</b>	1.00
<b>Permanent Mat</b>	<b>Type 1:</b>	2.00	<b>Type 2:</b>	3.00	<b>Type 3:</b>	5.00
<b>RCP</b>	<b>Type B:</b>	6.00				

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE (ft.)	LENGTH (ft.)	RADIUS (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
		C	550.00	0.00	3.00	3.00	0.0100	23.16	23.16	0.15	3.47	Seed	4.71	25	0.030	17.57	3.50	0.78	16.37	1.25	7.50
												Jute Mat	4.62	25	0.040	18.19	2.80	0.86	16.06	1.38	8.29
												Temp. Mat	4.62	25	0.040	18.19	2.80	0.86	16.06	1.38	8.29
												Temp. Mat	4.62	25	0.040	18.19	2.80	0.86	16.06	1.38	8.29



## DITCH ANALYSIS

**PID :**

**Date :** 10/02/2009

**Project :** OU16 Temporary Ditches

**Location :** OU16 Lakeview Bluffs

**Description :** Easterly ditch from CB#36 and CB#44

**Designer : LCS**

Rainfall Area : A

### Allowable Shears

Seed: 0.30

**Jute Mat:** 0.45

**Temporary Mat:** 1.00

Permanent Mat	Type 1:	2.00
---------------	---------	------

Type 2: 3.00

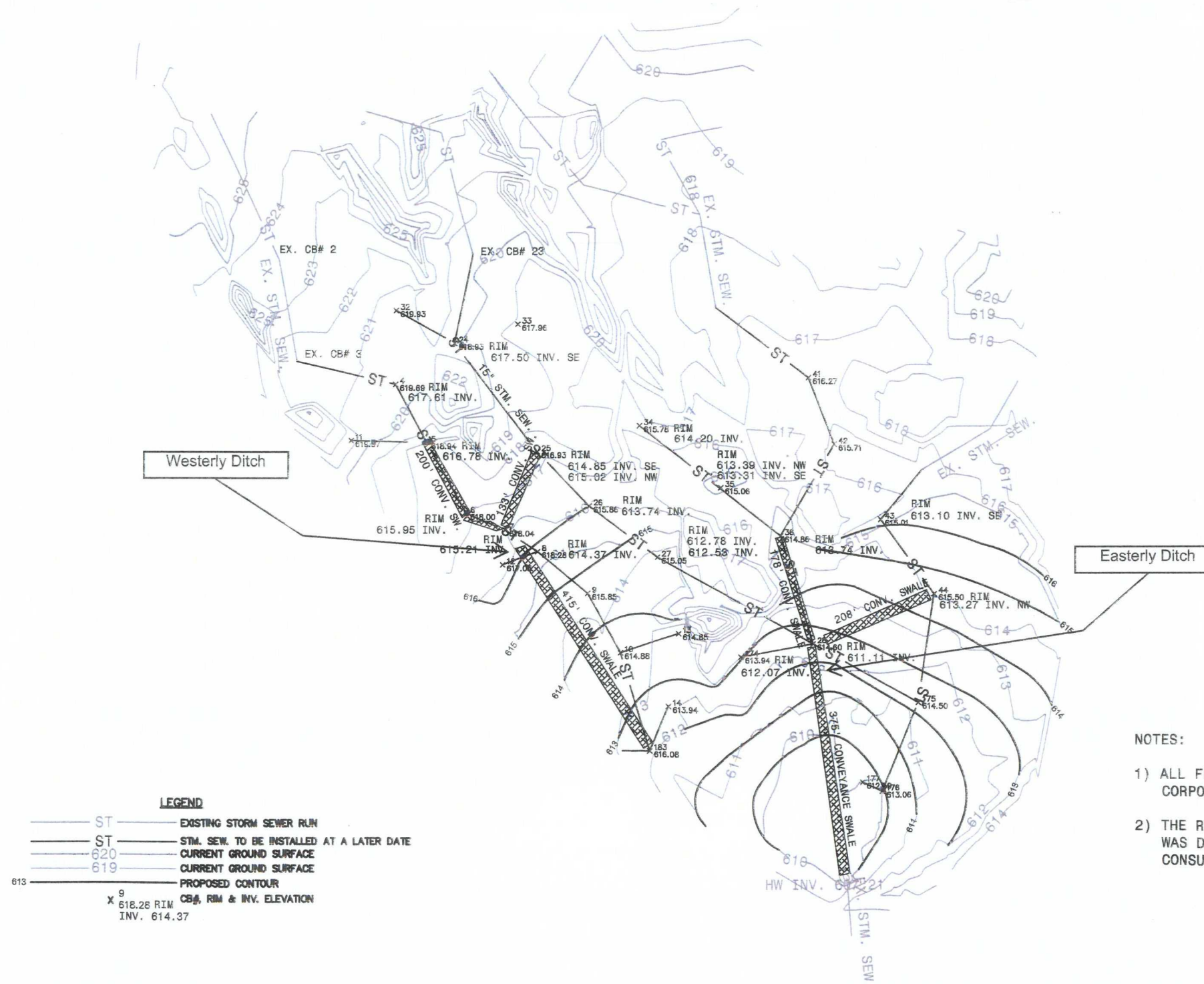
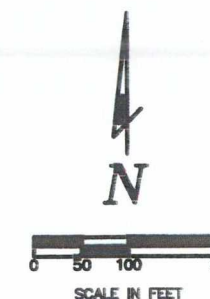
Type 3: 5.00

RCP Type B: 6.00

(\*) Warning: Grade is steeper than allowable.

If value is parantheses, design parameters have been exceeded. - See user manual.

STATION	SIDE LENGTH	RADIUS	IN	BACK	GRADE	AREA	AREA	RUNOFF	CA	PROTECT	RAIN	STORM	MANN.	TIME	VEL.	SHEAR	DESIGN	DEPTH	WIDTH	
BEGIN	END	(ft.)	WIDTH	SLOPE	SLOPE	(ft./ft.)	(acres)	SUM	COEFF.	(Sum)	TYPE	INT.	FREQ.	COEFF.	FLOW	FLOW	(lbs./sq.ft.)	FLOW	FLOW	FLOW
		(ft.)	(ft.)	(ft./ft.)	(ft./ft.)			(acres)				(in./hr.)	(yrs.)		(min.)	(fps.)		(cfs.)	(ft.)	(ft.)
	C	550.00	0.00	3.00	3.00	0.0100	23.16	23.16	0.15	3.47	Seed	5.02	50	0.030	17.52	3.55	0.80	17.45	1.28	7.68
											Jute Mat	4.92	50	0.040	18.13	2.85	0.88	17.11	1.42	8.49
											Temp. Mat	4.92	50	0.040	18.13	2.85	0.88	17.11	1.42	8.49
											Temp. Mat	4.92	50	0.040	18.13	2.85	0.88	17.11	1.42	8.49



- LEGEND**
- ST — EXISTING STORM SEWER RUN
  - ST — STM. SEW. TO BE INSTALLED AT A LATER DATE
  - 620 — CURRENT GROUND SURFACE
  - 619 — CURRENT GROUND SURFACE
  - 613 — PROPOSED CONTOUR
  - X<sup>9</sup> 618.28 RIM  
INV. 614.37 — CB# RIM & INV. ELEVATION

**NOTES:**

- 1) ALL FEATURES ON THIS MAP WERE OBTAINED FROM URS CORPORATION.
- 2) THE REVISED SET OF PROJECT REQUIREMENTS FOR THIS AREA WAS DEVELOPED BY HULL & ASSOCIATES, INC., CT CONSULTANTS AND URS CORPORATION.

**Hull**

& associates, inc.

ENGINEERS | GEOLOGISTS | SCIENTISTS | PLANNERS

4 HEMISPHERE WAY  
BEDFORD, OHIO 44146

PHONE: (440) 232-9945  
FAX: (440) 232-9946  
WWW.HULLINC.COM

© 2008 HULL & ASSOCIATES, INC.

DESIGN MODIFICATION TO OPERABLE UNITS 16 (OU16)  
SITE GRADING AND LANDFILL CAP IMPROVEMENTS PROJECT

**FIGURE 2**

**OU16 GRADING AND DRAINAGE  
DESIGN MODIFICATIONS**

FORMER DIAMOND SHAMROCK PAINESVILLE WORKS SITE  
PAINESVILLE, LAKE COUNTY, OHIO

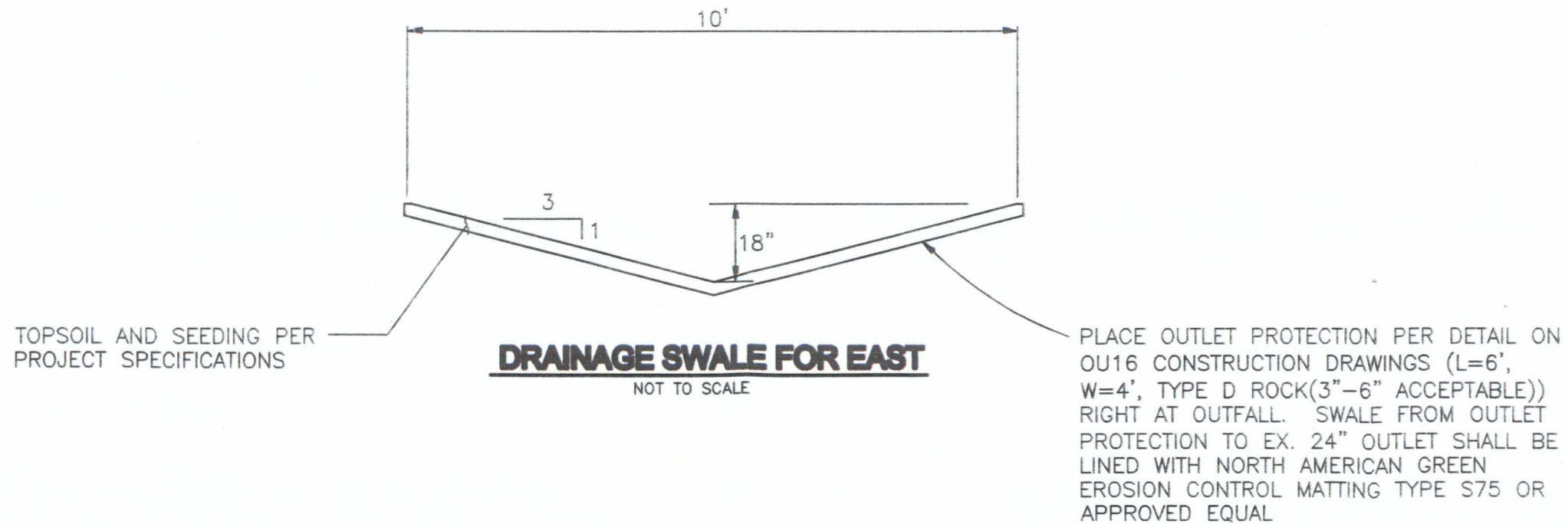
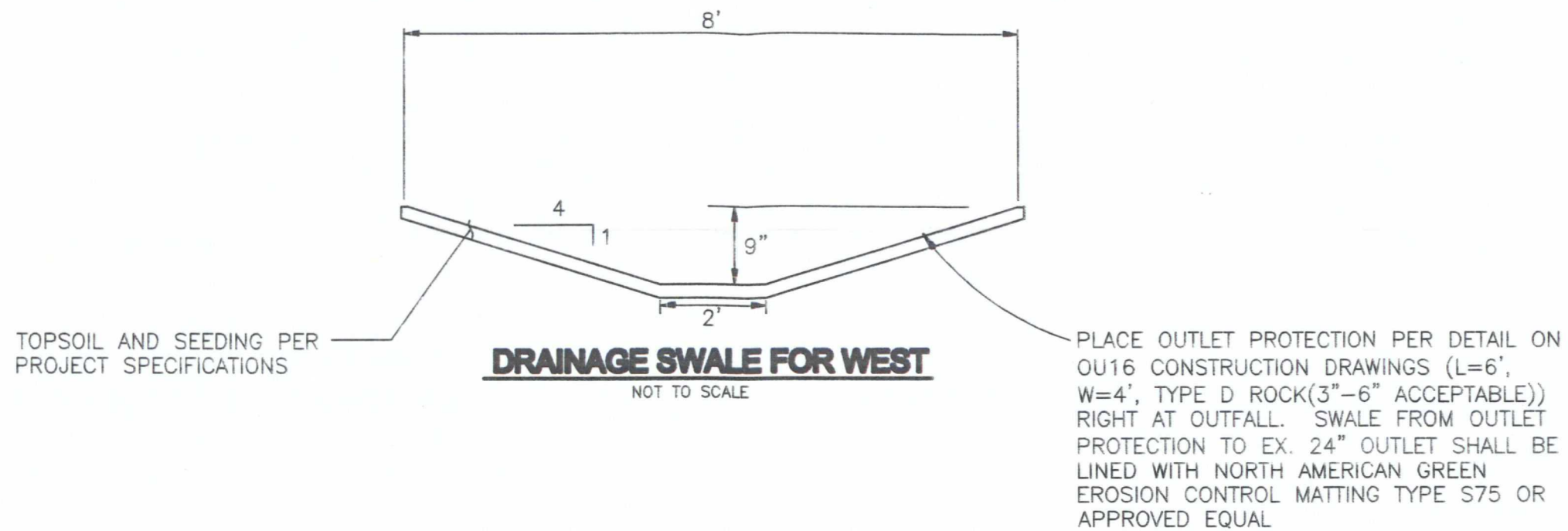
PROJECT NO.: TER016

SUBMITTAL DATE: SEPTEMBER 2009

CAD DWG FILE: TER016.100.0001 GAC

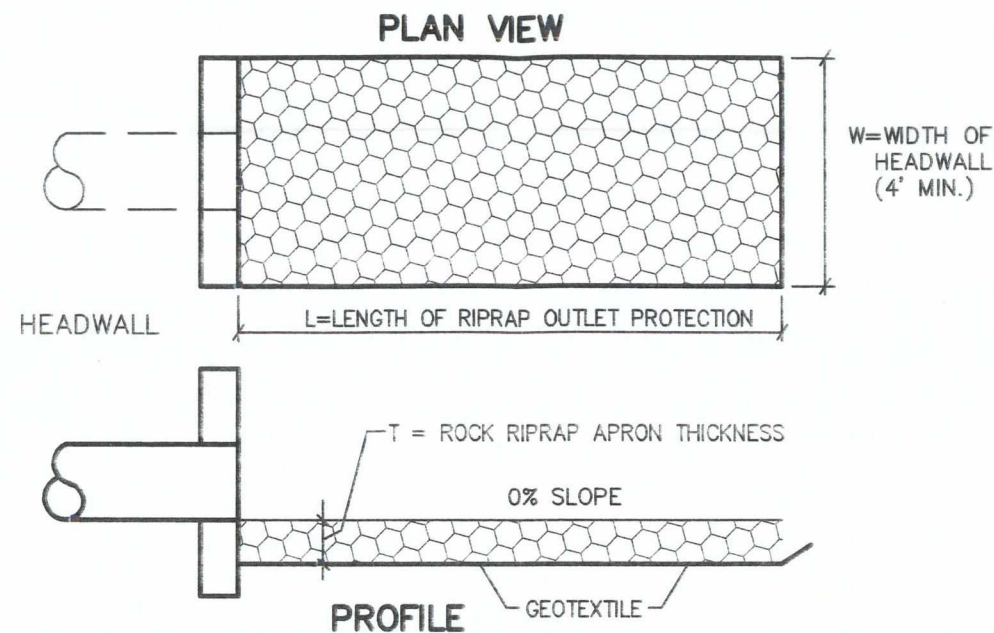
PLOT DATE: 9/14/09

# OU16 DRAINAGE SWALES LAKEVIEW BLUFFS





# OU16 DRAINAGE SWALES LAKEVIEW BLUFFS



## NOTES:

1. THE SUBGRADE FOR THE FILTER AND RIPRAP SHALL BE PREPARED TO THE REQUIRED LINES AND GRADES SHOWN ON THE PLAN.
2. THE RIPRAP SHALL CONFORM TO THE GRADING LIMITS AS SHOWN ON THE PLAN.
3. GEOTEXTILE SHALL BE WOVEN OR NONWOVEN MONOFILAMENT YARN AND SHALL MEET THE FOLLOWING:
  - THICKNESS 20-60 MILS
  - GRAB STRENGTH 90-120 LBS
  - ASTM D-1777 AND ASTM D-1682
4. RIPRAP MAY BE PLACED BY EQUIPMENT BUT SHALL BE PLACED IN A MANNER TO PREVENT DAMAGE TO THE GEOTEXTILE.

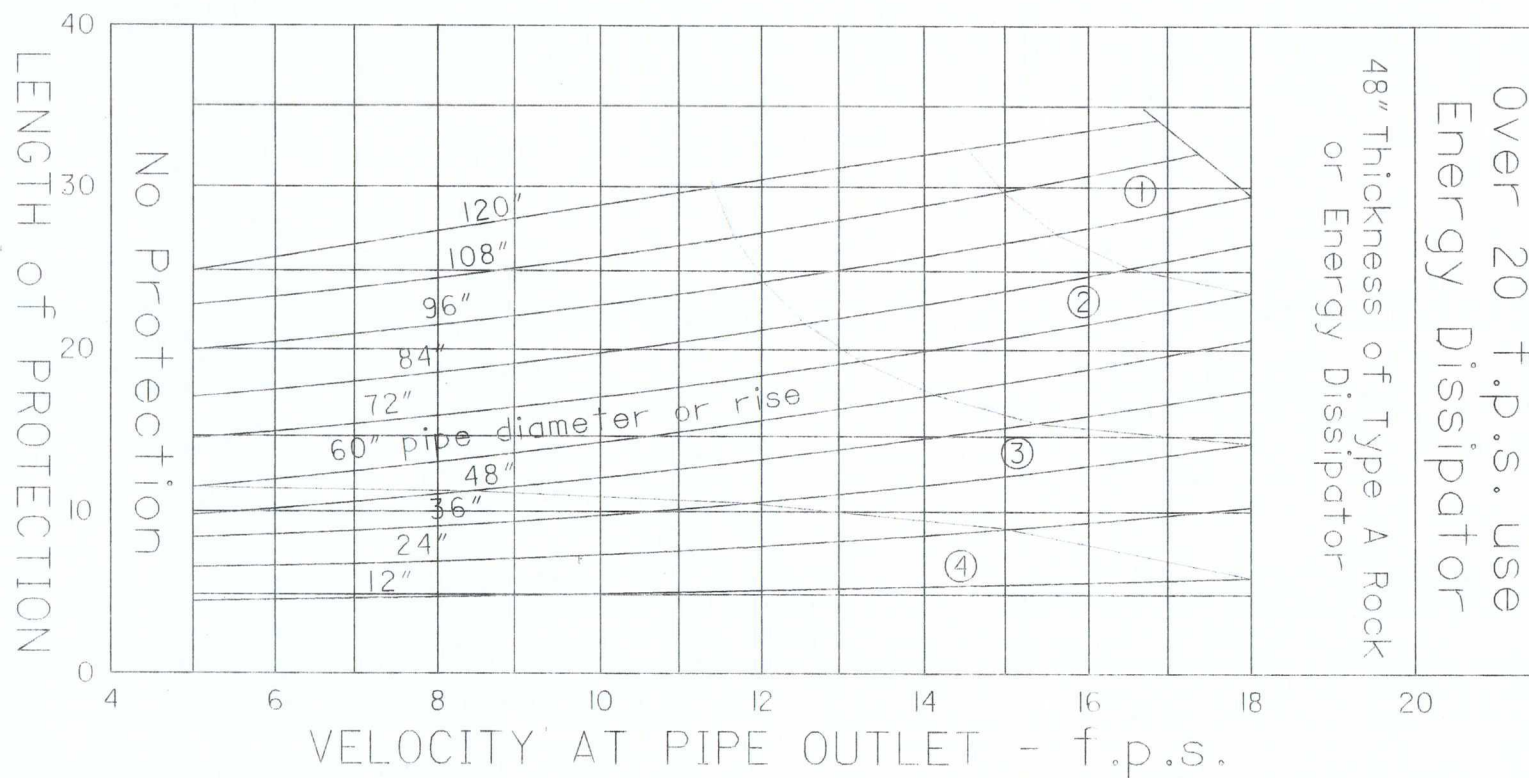
## **STORM SEWER OUTLET PROTECTION**

NO SCALE



# ROCK CHANNEL PROTECTION AT CULVERT AND STORM SEWER OUTLETS

1107-1  
REFERENCE SECTION  
1107.2



## NOTES

Rock size (6", 12", 18") indicates the square opening on which 85% of the material, by weight, will be retained.

The width of protection shall be the width of the headwall, with 4' being the minimum.

(Where a stream bed will withstand the calculated velocity without erosion, no rock channel protection will be required.)

## LEGEND

- ① 48" of 18" rock
- ② 36" of 18" rock
- ③ 30" of 12" rock
- ④ 18" of 6" rock

## ROCK TYPE

A  
A  
B  
C



# Material and Performance Specification Sheet

North American Green  
14649 Highway 41 North  
Evansville, IN 47725  
800-772-2040  
FAX: 812-867-0247  
[www.nagreen.com](http://www.nagreen.com)

A **tensar** Company

## S75 Erosion Control Blanket

The short-term single net erosion control blanket shall be a machine-produced mat of 100% agricultural straw with a functional longevity of up to 12 months. (NOTE: functional longevity may vary depending upon climatic conditions, soil, geographical location, and elevation). The blanket shall be of consistent thickness with the straw evenly distributed over the entire area of the mat. The blanket shall be covered on the top side with a lightweight photodegradable polypropylene netting having an approximate 0.50 x 0.50 (1.27 x 1.27 cm) mesh. The blanket shall be sewn together on 1.50 inch (3.81 cm) centers with degradable thread.

The S75 shall meet requirements established by the Erosion Control Technology Council (ECTC) Specification and the US Department of Transportation, Federal Highway Administration's (FHWA) *Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects, FP-03 Section 713.17 as a type 2.C Short-term Single Net Erosion Control Blanket*.

The blanket shall be manufactured with a colored thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) as an overlap guide for adjacent mats.

Material Content		
<b>Matrix</b>	100% Straw Fiber	0.5 lbs/yd <sup>2</sup> (0.27 kg/m <sup>2</sup> )
<b>Nettings</b>	Top side only, lightweight photodegradable	1.5 lb/1000 ft <sup>2</sup> ( 0.73 kg/100 m <sup>2</sup> ) approx. weight
<b>Thread</b>	degradable	

S75 is available in the following standard roll sizes:

<b>Width</b>	4.0 ft (1.2 m)	6.67 ft (2.03 m)	16 ft (4.87 m)
<b>Length</b>	135 ft (41.14 m)	108 ft (32.92 m)	108 ft (32.92 m)
<b>Weight ± 10%</b>	30 lbs (13.6 kg)	40 lbs (18.14 kg)	96 lbs (43.54 kg)
<b>Area</b>	60 yd <sup>2</sup> (50.16 m <sup>2</sup> )	80.0 yd <sup>2</sup> (66.9 m <sup>2</sup> )	192 yd <sup>2</sup> (165.5 m <sup>2</sup> )

### Index Value Properties:

Property	Test Method	Typical
Thickness	ASTM D6525	0.37 in (9.4 mm)
Resiliency	ECTC Guidelines	78.8%
Water Absorbency	ASTM D1117	426%
Mass/Unit Area	ASTM 6475	11.97 oz/yd <sup>2</sup> (407 g/m <sup>2</sup> )
Swell	ECTC Guidelines	15%
Smolder Resistance	ECTC Guidelines	Yes
Stiffness	ASTM D1388	6.31 oz-in
Light Penetration	ECTC Guidelines	7.3%
Tensile Strength –MD	ASTM D6818	130.8 lbs/ft (1.94 kN/m)
Elongation – MD	ASTM D6818	24.4%
Tensile Strength – TD	ASTM D6818	85.2 lbs/ft (1.26 kN/m)
Elongation – TD	ASTM D6818	26.8%

### Performance Design Values:

Maximum Permissible Shear Stress	
Unvegetated Shear Stress	1.55 lbs/ft <sup>2</sup> (74 Pa)
Unvegetated Velocity	5.00 ft/s (1.52 m/s)

Slope Design Data: C Factors			
	Slope Gradients (S)		
Slope Length (L)	≤ 3:1	3:1 – 2:1	≥ 2:1
≤ 20 ft (6 m)	0.029	NA	NA
20-50 ft	0.11	NA	NA
≥ 50 ft (15.2 m)	0.19	NA	NA

### Bench Scale Testing\* (NTPEP):

Test Method	Parameters	Results
ECTC Method 2 Rainfall	50 mm (2 in)/hr for 30 min	SLR** = 8.80
	100mm (4 in)/hr for 30 min	SLR** = 8.16
	150 mm (6 in)/hr for 30 min	SLR** = 7.81
ECTC Method 3 Shear Resistance	<b>Shear at 0.50 inch soil loss</b>	<b>1.80 lbs/ft<sup>2</sup></b>
ECTC Method 4 Germination	Top Soil, Fescue, 21 day incubation	228% improvement of biomass

\* Bench Scale tests should not be used for design purposes

\*\* Soil Loss Ratio = Soil loss with Bare Soil/Soil Loss with RECP (soil loss is based on regression analysis)

Roughness Coefficients- Unveg.	
Flow Depth	Manning's n
≤ 0.50 ft (0.15 m)	0.055
0.50 – 2.0 ft	0.055 – 0.021
≥ 2.0 ft (0.60 m)	0.021

Product Participant of:



Updated 3/09